We Claim:

1. A method of forming a conformal thin film of silicon oxide on a substrate having spaced conductive lines thereon comprising the steps of:

mounting a substrate onto a substrate support in a vacuum chamber;

forming a plasma in the vacuum chamber in a region above the substrate by means of an electrical power source from a reaction gas comprising a mixture of tetraethylorthosilicate and a fluorine-containing halocarbon gas selected from the group consisting of CX_4 and $CX_3\text{-}(CX_2)_n\text{-}CX_3$ wherein X is hydrogen or halogen and n is an integer from 0 to 5 with the proviso that at least one X is fluorine; and

subjecting the substrate to the plasma so as to deposit a layer of silicon oxide containing at least about 2.5 atomic percent of fluorine onto the substrate without the formation of voids in the film.

2. The method of claim 1 wherein the plasma is created from the tetraethylorthosilicate and C_2F_6.

3. The method of claim 1 wherein the plasma is created by means of two power sources having different frequencies.

4. The method of claim 3 wherein the plasma is created by means of one power source having a frequency of about 13.56 MHz and a second power source having a frequency of between 50 KHz and 1000 KHz.

5. The method of claim 4 wherein the second power source has a frequency of about 400 ~~Khz.~~ KHz

6. The method of claim 1 wherein a single power source having a frequency of about 13.56 MHz is used.

7. The method of claim 1 wherein said power source is a source of microwave power.

8. A method of forming a conformal thin film of silicon oxide over a substrate having spaced conductive lines thereon in a plasma chamber comprising

mounting a substrate in said chamber;

introducing into the chamber in a region above said substrate as a plasma precursor gas vaporized tetraethylorthosilicate in a carrier gas including oxygen and a fluorocarbon selected from the group consisting of

CX_4 and CX_3-$(CX_2)_n$-CX_3

wherein X is hydrogen or fluorine and n is an integer from 0 to 5 with the proviso that at least one X is fluorine;

and thereafter forming a plasma therefrom, so as to deposit a layer of silicon oxide containing at least about 2.5 atomic percent of fluorine over said conductive lines.

9. A method according to claim 8 wherein the plasma precursor gas contains a ratio of silicon:fluorine of about 14:1.

10. A method according to claim 8 wherein the conductive lines are less than 1 micron in width and no more than 1 micron apart.

11. In a processing chamber, a method of depositing a layer having a predetermined intrinsic stress level over a substrate, the method comprising:

(a) distributing a halogen source to said processing chamber at a selected rate, said selected rate being chosen according to said predetermined stress level;

(b) introducing a process gas comprising silicon, oxygen and said halogen source into said chamber; and

(c) forming a plasma from said process gas to deposit said layer having said predetermined intrinsic stress level over said substrate.

12. The method of claim 11 wherein said predetermined stress level is a compressive stress level.

13. The method of claim 11 wherein said halogen source comprises a fluorine source.

14. The method of claim 13 wherein said fluorine source is selected from the group consisting of CF_4, C_2F_6, SiF_4, and TEFS.

15. The method of claim 14 wherein said silicon source comprises TEOS.

16. The method of claim 15 wherein said predetermined intrinsic stress level is between about -1.0×10^9 dynes/cm^2 and -0.5×10^9 dynes/cm^2.

17. The method of claim 16 wherein a dielectric constant of said layer is between about 3.8 to 4.1.

18. The method of claim 13 further comprising steps of:

(d) repeatedly performing steps (a) through (c) to deposit a halogen-doped silicon oxide film on a plurality of substrates;

(e) measuring the intrinsic stress of said deposited halogen-doped silicon oxide film on each of said plurality of substrates; and

(f) if said intrinsic stress of said deposited halogen-doped silicon oxide films is too high, increasing said selected rate at which said halogen source is introduced during deposition of a halogen-doped silicon oxide film over a subsequently processed substrate to lower the intrinsic stress of said subsequently deposited halogen-doped silicon oxide film, and if said intrinsic stress of said

deposited halogen-doped silicon oxide films is too low, decreasing said selected rate at which said halogen source is introduced during deposition of a halogen-doped silicon oxide film over a subsequently processed substrate to increase the intrinsic stress of said subsequently deposited halogen-doped silicon oxide film.

19. The method of claim 13 wherein said selected rate is determined from a database of measured intrinsic stress levels of previously deposited films.

20. The method of claim 11 wherein said processing chamber comprises a high-density plasma chemical vapor deposition chamber and said plasma is formed by application of radio-frequency power to a coil.

21. In a processing chamber, a method of depositing a layer having a selectively varied stress level on a substrate, the method comprising:

(a) distributing a halogen source to said processing chamber at a first selected rate, said first selected rate being chosen according to a first predetermined stress level;

(b) introducing a process gas comprising silicon, oxygen and said halogen source into said chamber;

(c) forming a plasma from said process gas to deposit a first portion of the layer having said first predetermined intrinsic stress level over said substrate; and then

(d) distributing the halogen source to said processing chamber at a second selected rate, said second selected rate being chosen according to a second predetermined stress level to deposit a second portion of the layer on the first portion of the layer, said second portion of the layer having said second predetermined intrinsic stress level.

22. The method of claim 21 where said first predetermined stress level is compressive and said second predetermined stress level is tensile.

23. The method of claim 21 where said first predetermined stress level is tensile and said second predetermined stress level is compressive.

24. A substrate processing system comprising:

a housing for forming a vacuum chamber;

a substrate holder, located within said housing, for holding a substrate;

a gas delivery system configured to introduce a process gas into said vacuum chamber;

a plasma generation system configured to form a plasma from said process gas;

a controller for controlling said gas delivery system and said plasma generation system; and

a memory coupled to said controller comprising a computer readable medium having a computer readable program embodied therein for directing operation of said substrate processing system, said computer readable program comprising:

a first set of instructions for controlling said gas delivery system to introduce a process gas comprising silicon, oxygen, and a halogen source into said gas mixing area; and

a second set of instructions for controlling said plasma generation system to form a plasma from said gases by said first set of instructions to deposit a layer over said substrate;

whereby said first set of instructions controls said gas delivery system to introduce said halogen source into said gas mixing area at a selected rate so that said deposited layer has a predetermined intrinsic stress level.

25. The substrate processing system of claim 24 wherein said first set of instructions controls said gas delivery system to introduce a fluorine source as said halogen source into said gas mixing area at a selected rate so that said deposited layer has a stress level of between -1.0 to -0.5×10^9 dynes/cm^2.

26. The substrate processing system of claim 24 wherein said first set of instructions controls said gas delivery system to introduce said fluorine source into said chamber at a rate that is about 20% or less of the total gas flow into said chamber.

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